



# First record of the genus *Anatopynia* Johannsen, 1905 (Diptera, Chironomidae) from Slovakia, in a semi-permanent oxbow lake

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**Abstract.** We present the first record of *Anatopynia plumipes* (Fries, 1823) from Slovakia. Larva of this species was found in a semi-permanent oxbow lake, a remnant of a plesiopotamal-type side arm of the Danube River.

**Keywords.** Danube Floodplain, macroinvertebrates, monitoring, Pannonian ecoregion

Academic editor: Fabio Laurindo da Silva

Received 12 January 2023, accepted 28 February 2023, published 16 March 2023

Vráblová Z, Kokavec I, Navara T, Mlaka M, Hamerlík L (2023) First record of the genus *Anatopynia* Johannsen, 1905 (Diptera, Chironomidae) from Slovakia, in a semi-permanent oxbow lake. Check List 19 (2): 177–181. <https://doi.org/10.15560/19.2.177>

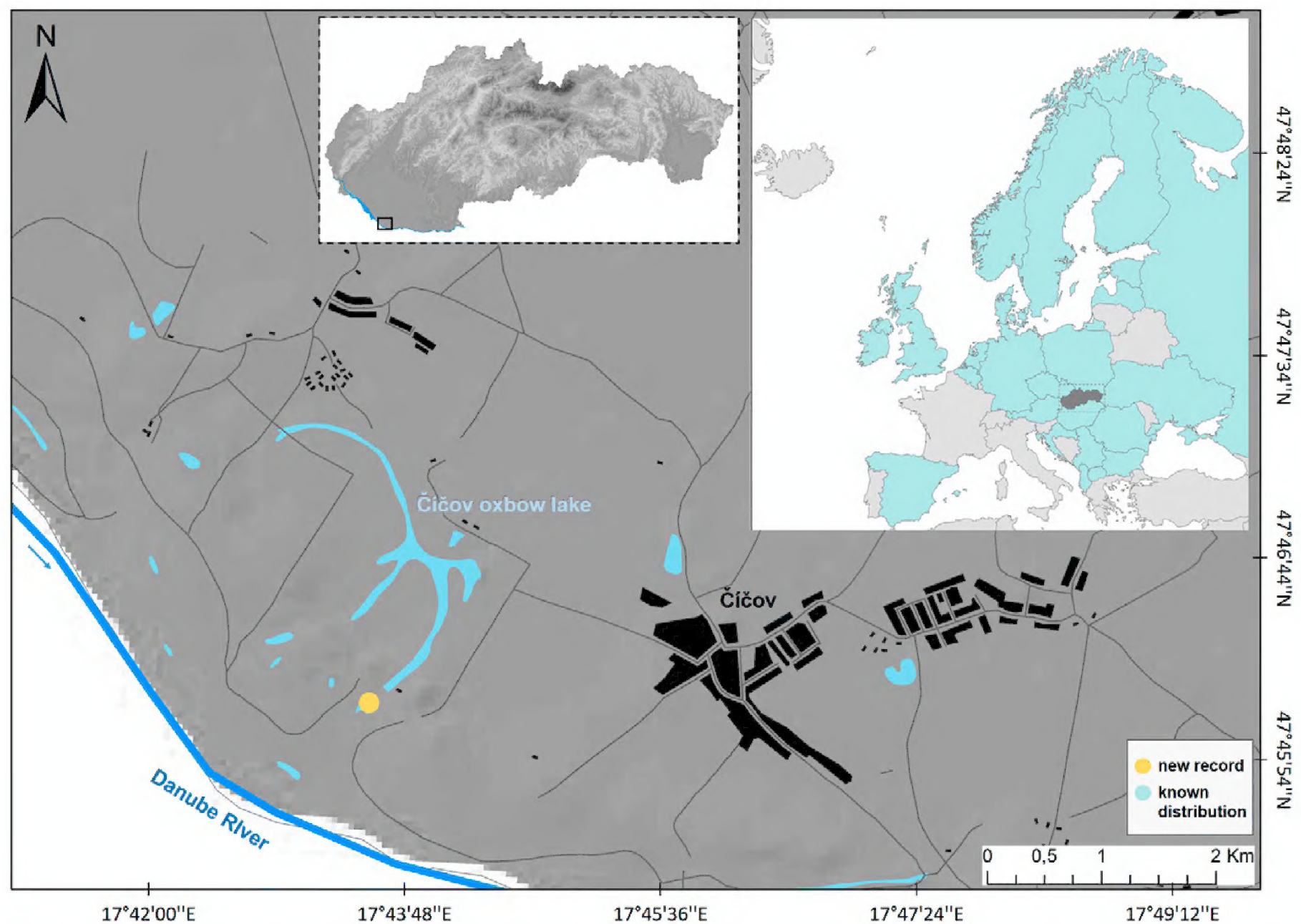
## Introduction

Semi-permanent waters dry up irregularly in exceptionally dry years. Compared to permanent waters, semi-permanent waters show less spatial heterogeneity and greater water level fluctuations (Sahuquillo et al. 2007). Species richness and abundance in semi-permanent waters is intermediate compared to permanent and temporary waters, suggesting that the length of the hydroperiod is an important determinant of species diversity and abundance (Tarr et al. 2005). Characteristic species of such habitats have often evolved opportunistic or pioneering traits with a variety of drought-survival mechanisms.

The Danube floodplain has been affected in the past by extensive river regulation, agriculture, and forestry. Exceptionally negative interventions, such as the construction of the Gabčíkovo Hydro-electric Power Plant (GHPP) in Slovakia, have caused the separation of the floodplain from the main river channel and in turn, its significant reduction (Lisický and Mucha 2003). As a result, a decrease in the dynamics of the water regime and an increase in the sedimentation rate have been identified as the main threats to the Danube floodplain

(Krno et al. 1999; Farkas-Iványi and Guti 2014). Based on the results of the monitoring of aquatic biota these changes have caused decreased macroinvertebrate and zooplankton species diversity and confirmed the positive effect of artificial and natural flooding (Beracko et al. 2016; Illýová et al. 2017; Krno et al. 2018). Unfortunately, some large aquatic invertebrate groups, such as chironomids, have been excluded from long-term monitoring of the GHPP impacts on the Danube since 1997, but were reestablished in 2020. Beside the fact that including chironomids will increase the reliability of the ecological interpretation of the aquatic biota's response, it also shows that it has a potential to bring valuable faunistic information.

In the present paper, we report the finding of a chironomid *Anatopynia plumipes* (Fries, 1823), the only representative of genus *Anatopynia* Johannsen, 1905 (Diptera, Chironomidae) from the Palearctic region. The species has been found in most European countries (Fig. 1) and inhabits various types of medium-sized standing waters. Even though larvae of the genus have previously been documented in Slovakian limnological studies (see Bitušík and Hamerlík 2003 and references therein), interestingly, the taxon has never appeared



**Figure 1.** *Anatopynia plumipes*, location of the new record in Slovakia and its geographic distribution. Data sources: Ashe and O'Connor (2009); Baranov (2011); Milošević et al. (2011); Spies and Sæther (2013); Orendt et al. (2014); Čerba et al. (2020); GBIF Secretariat (2022).

in either national checklists (Bitušík and Brabec 2009) or international inventories (Spies and Sæther 2013). Thus, this discovery is the first confirmed record of the genus for the Slovak fauna. At the same time, to our best knowledge, it is the first time the species has been found in a semi-permanent habitat, shedding new light on the species' life history.

## Methods

The study site is a remnant of a plesiopotamal-type side arm of the Danube River, Čičov oxbow lake, which remained after being cut off by a flood barrier (Figs. 1,

2). The site is hydrologically unstable and depends on the hydrological regime of the Danube, as it is connected to the river during extreme floods. By autumn the site may partially dry out, with the remaining water forming a pool in the middle of the lake. In 2022 (and previously also in 2018) the site dried completely, and water remained only in a small depression (Fig. 2B). In the spring, the side arm gets reconnected with the main channel of the Danube and fills with water. The structure of the macrophyte community is also driven by this hydrological regime. The bottom of the oxbow lake is covered with submerged aquatic plants, such



**Figure 2.** View of the study site. **A.** The remnant of the oxbow lake Čičov, showing the water-filled stage in the spring. **B.** The site almost entirely dry in autumn (September 2022). Photo Igor Kokavec.

as *Ceratophyllum demersum* L., *Myriophyllum spicatum* L., *Elodea canadensis* Michx., *Nymphoides peltata* (S.G. Gmel.) Kuntze, and *Trapa natans* L. (Matečný et al. 2020). In spring, when the side arm is full of water (Fig. 2A), several fish species occur here, such as *Carassius auratus* (Linnaeus, 1758) (Goldfish), *Rutilus rutilus* (Linnaeus, 1758) (Roach), and *Alburnus alburnus* (Linnaeus, 1758) (Bleak) (Kubala et al. 2021). The chironomid community of the site is species-poor, and, except for *Anatopynia*, consists of genera such as *Chironomus*, which is highly dominant in the community, *Procladius* Skuse, 1889, *Tanypus* Meigen, 1803, *Glyptotendipes* Kieffer, 1913, and *Tanytarsus* van der Wulp, 1874. Table 1 shows basic environmental variables of the site. Kick samples were taken on 26 April 2022 within routine monitoring of the Danube and its side arms focusing on the impact of the GHPP on the environment. The sampled area (ca. 0.625 m<sup>2</sup> in total) was about 0.3 m deep and the habitat sampled represented 100% organic-rich sediment.

Results

*Anatopynia plumipes* (Fries, 1823)

Figure 3

**New record.** SLOVAKIA – NITRA REGION • CHKO Dunajské luhy, Číčov oxbow lake; 47°46'31.4"N, 017°43'58.8"E; 112 m alt.; 26.IV.2022; L. Hamerlík et Z. Vráblová leg.; benthic sample; kicking technique; 1 larva, slide 1855/22-1.

The larva of *Anatopynia plumipes* (Fries, 1823) represents the first confirmed record of this species for the Slovak fauna.

**Identification.** Fittkau (1962) considered *Anatopynia* the most primitive genus in the subfamily Tanypodinae, although that has been challenged by recent phylogenetic studies (Silva and Ekrem 2016; Krosch et al. 2017), and placed it in a separate tribe, Anatopyniini. Distinctive larval characters of the genus are 5-segmented antennae (unique within Tanypodinae); multiple rows of teeth on pecten hypopharyngis; numerous dorsomental teeth; a robust, strongly curved mandible without basal tooth and with 2 accessory teeth; relatively short procereus (ca. 2.5× as long as wide) carrying up to 25 anal setae, compared to fewer than 20 in other Tanypodinae (Cranston and Epler 2013: fig. 3A–E). *Anatopynia plumipes* is the only Palaearctic species of the genus widespread all over much of Europe, except

for its southern and western parts; for a detailed distribution of the species see Figure 1.

Discussion

Larvae of *Anatopynia plumipes* inhabit shallow ponds and lakes, marshes, and bogs. In the present case, however, the larva was recorded in a semi-permanent habitat where this species has not been found before. Larvae can tolerate very low-oxygen concentrations for a long time, and thus they frequently occupy eutrophic waters. The single larva of this species collected at the site is in accordance with findings from the Netherlands, where Vallenduuk and Moller Pillot (2007) documented very few larvae in samples. Due to their univoltinity, larvae of *A. plumipes* cannot survive in temporary waters, unless they have the opportunity to find a moist bottom (Vallenduuk and Moller Pillot 2007). Adults are decent fliers, and thus the species has good colonization potential, which explains its occurrence in isolated ponds. In European countries, adults fly from mid-February to May (Fittkau 1962; Vallenduuk and Moller Pillot 2007). In the Czech Republic, *Anatopynia* lives in carp ponds and adults emerge in March, but larvae appear as late as in October, which according to Matěna (pers. comm at Bitušík and Hamerlík 2013) means that oligopause occurs in younger instar larvae. On the contrary, Shilova and Zelentsov (1972) found that diapause occurs in the fourth instar larvae and is driven by passing a cold period rather than a photoperiod. As mentioned earlier, the study site has occasionally dried completely in the near past. It is likely that with ongoing climate change, drying will become more frequent and the site will serve as an ideal habitat to study mechanisms how aquatic insects deal with periods of drought.

Acknowledgements

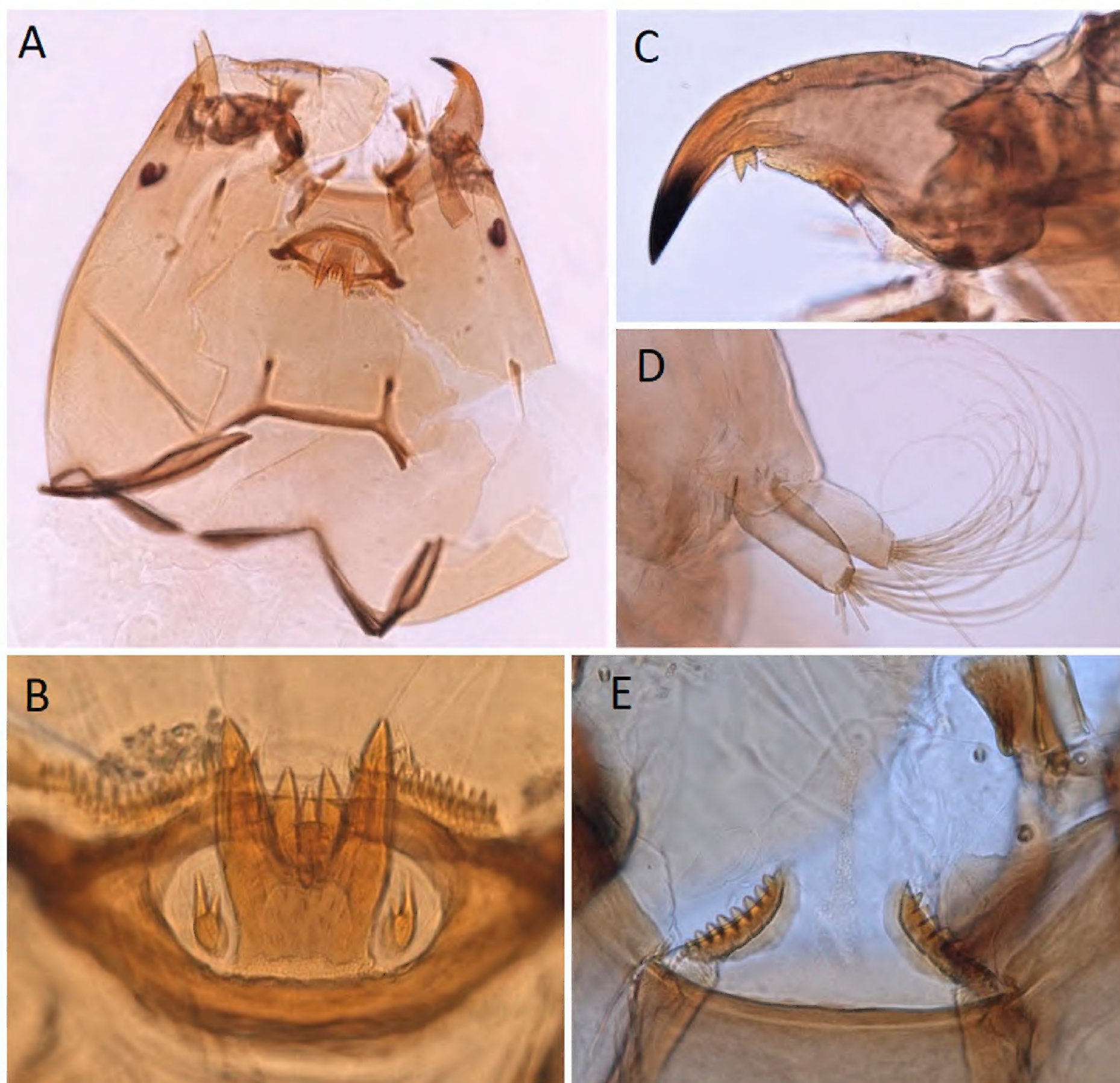
Samples were taken in the framework of the project Monitoring of the impact of the Gabčíkovo-Nagymaros hydroelectric power plant on the environment and LIFE14 NAT/SK/001306. Comments on the manuscript by Peter Bitušík (Matej Bel University) and two anonymous reviewers are greatly appreciated.

Author Contributions

Conceptualization: ZV. Investigation: ZV. Methodology: MM. Validation: LH. Visualization: IK, LH. Writing – original draft: LH. Writing – review and editing: IK, TN.

**Table 1.** Basic characteristics of the monitoring site. Environmental variables are based on monthly measurement in 2010. In case of environmental variables yearly mean values and minimum–maximum values are shown. Abbreviations: Temp. = water temperature, DO = dissolved oxygen, Cond. = electric conductivity, TP = total phosphorus, TN = total nitrogen (ME SR 2011).

Variable (unit)	Temp. (°C)	DO (mg·L <sup>-1</sup> )	pH	Cond. (mS·m <sup>-1</sup> )	TP (mg·L <sup>-1</sup> )	TN (mg·L <sup>-1</sup> )
Mean value	11.1	6.0	7.72	56.8	0.05	0.80
Min–max	0.2–25.2	1.2–12.2	7.49–7.91	45.7–83.1	0.02–0.09	0.46–1.17



**Figure 3.** Larva of *Anatópynia plumipes* recorded in Slovakia. **A.** Head capsule. **B.** Ligula, paralingulae and pecten hypopharyngis. **C.** Mandible with characteristic two large accessory teeth. **D.** Anal end of the body showing procerci and anal setae. **E.** Mentum with dorsomental teeth, M-appendage and pseudoradula.

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